BEST EVIDENCE TOPIC REPORTS

Towards evidence based emergency medicine: Best BETs from the Manchester Royal Infirmary

Edited by Simon D Carley

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Best Evidence Topic reports (BETs) summarise the evidence pertaining to particular clinical questions. They are not systematic reviews, but rather contain the best (highest level) evidence that can be practically obtained by busy practicing clinicians. The search strategies used to find the best evidence are reported in detail in order to allow clinicians to update searches whenever necessary. Each BET is based on a clinical scenario and ends with a clinical bottom line which indicates, in the light of the evidence found, what the reporting clinician would do if faced with the same scenario again.

The BETs published below were first reported at the Critical Appraisal Journal Club at the Manchester Royal Infirmary¹ or placed on the BestBETs website. Each BET has been constructed in the four stages that have been described elsewhere.² The BETs shown here together with those published previously and those currently under construction can be seen at <http://www.bestbets.org>.³ 4 BETs are included in this issue of the journal. Details on how to do a BET are available online at <http://www.bestbets.org/home/participation.html>. Four BETs are included in this issue or the journal.

- ▶ Use of Heliox in the management of acute exacerbation of COPD
- ▶ Is CT effective in cases of upper oesophageal fish bone ingestion?
- ▶ Does plain radiography predict pneumothorax size?
- ▶ Is defibrillation effective in accidental severe hypothermia in adults?

1. Carley SD, Mackway-Jones K, Jones A, *et al.* Moving towards evidence based emergency medicine: use of a structured critical appraisal journal club. *J Accid Emerg Med* 1998;**15**:220–222.
2. Mackway-Jones K, Carley SD, Morton RJ, *et al.* The best evidence topic report: A modified CAT for summarising the available evidence in emergency medicine. *J Accid Emerg Med* 1998;**15**:222–226.
3. Mackway-Jones K, Carley SD. [bestbets.org](http://www.bestbets.org): Odds on favourite for evidence in emergency medicine reaches the worldwide web. *J Accid Emerg Med* 2000;**17**:235–6.

Use of Heliox in the management of acute exacerbation of COPD

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Three part question

In [patients with acute COPD] does [the administration of heliox] improve [survival, Peak flow, reduce time in hospital or reduce the need for mechanical ventilation]?

Clinical scenario

A 45-year-old male smoker attends the emergency department with exacerbation of chronic obstructive pulmonary disease. Repeated doses of nebulised Salbutamol and Ipratropium Bromide has been administered and Aminophyllin infusion has been commenced. You feel that the patient will require intubation and ventilation. You have got access to Heliox and you feel that it might improve the condition of the patient and might avoid intubation. Is there any evidence to support use of Heliox in such situation?

Search strategy

Medline (1951 to date) Embase (1974 to date)

Dialog Datastar web (Athens) search terms [HELIUM#.W.DE., OXYGEN#.W.DE. and PULMONARY-DISEASE-CHRONIC-OBSTRUCTIVE#.DE.]

Cochrane Library: Heliox

Reference review: A search of references from articles found by electronic searching was done.

BOC Medical Group: (manufacturer firm for Heliox) was contacted. No new articles found.

Search outcome

Altogether 35 articles were found, of which 9 were relevant to the clinical question.

Comment(s)

The physical properties of heliox become increasingly similar to those of air-oxygen mixture when the concentration of oxygen exceeds 40%. The cost of heliox is significant.

Most trials are unsatisfactory; chief concerns being poor concealment of allocation and lack of blinding.

▶ CLINICAL BOTTOM LINE

There is not enough evidence available from high quality studies dealing with NIV-Heliox in acute exacerbation of COPD patients to support the use of heliox to treat acute exacerbation of COPD in either ventilated or non-ventilated patients. Indeed, the clinical studies have actually shown that heliox does not really benefit more than air: oxygen mixture in decompensated COPD patients. Use of heliox increases the cost of treatment as well. Therefore, Heliox should not be used routinely in the management of acute COPD unless further strong evidence suggests its clinical benefit in acute COPD.

Swidwa D, Montenegro H, Goldman M, *et al.* Helium-oxygen breathing in severe COPD. *Chest* 1985;**87**:790–6.

Harrison P, Onorato D. The clinical effects of Helium-oxygen mixtures on gas exchange in exacerbation of COPD. *Chest* 1995;**108**:156s.

Joliet P, Tassaux D, Thouret JM, *et al.* Beneficial effects of Helium: oxygen versus air: oxygen noninvasive pressure support in patients with decompensated chronic obstructive pulmonary disease. *Critical Care Medicine* Nov 1999;**27**(11):2422–9, ISSN: 0090-3493.

Jaber S, Fodil R, Carlucci A, *et al.* Noninvasive ventilation with Helium-oxygen in acute exacerbation of chronic obstructive pulmonary disease. *Am J Resp Crit Care Med* 2000;**161**:1191–1200.

Andrews R, Lynch M. Heliox in the treatment of chronic obstructive pulmonary disease. *Emergency Medical Journal* Nov 2004;**21**(6):670–5, ISSN: 1472-0213.

Table 1

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Swidwa D, <i>et al</i> , 1985	15 male volunteer patients in Respiratory outpatient with stable but severe COPD. Intervention: 80:20 heliox breathing for 15 minutes compared with baseline air-oxygen breathing	Non-randomised and non-blinded crossover study Jadad score 1	PaCO ₂ (ABG)	Reduction of PaCO ₂ of 2 mm Hg	Low quality study Non-randomised and non-blinded Effect of heliox breathing in stable severe COPD
Harrison P, <i>et al</i> , 1995	10 patients with acute exacerbation of COPD in ICU. Intervention: 70:30 heliox breathing compared with air:oxygen in addition to conventional treatment.	Non-randomised & non-blinded crossover study Jadad score 1	PaCO ₂ (ABG)	52 v 44 mm Hg decrease in PaCO ₂ in heliox group but also fall in PaO ₂ 129 to 73 mm Hg	No indication of duration of treatment No details on statistical analysis
Jolliet P, <i>et al</i> , 1999, Switzerland	19 patients with severe COPD (FIV1 of 0.83 ± 0.31) in intensive care unit for NIV after initial stabilisation with NIV for no more than 24 h after ICU admission. Out of 25 eligible patients 5 were excluded (3 required an FIO ₂ >0.3 and 2 were intubated). Technical problem with data of one patient.	Prospective randomised cross-over study Single blinded Jadad score 3	Dyspnoea and PaCO ₂	NIV with heliox reduced dyspnoea and PaCO ₂ more than air:oxygen-	No concealment allocation. Study was performed in the absence of acute respiratory failure. All invasive techniques were prohibited by the ethical committee so work of breathing could not be determined.
Jaber S, <i>et al</i> , 2000, France	10 patients in Medical ICU having recent exacerbation of COPD with either tachypnoea acidosis or hypoxia- NIV. Intervention: NIV with 15-25 cm H ₂ O P5, breathing air:oxygen then 78:22 heliox for 20 min, measurements were made in final 5 min of treatment.	Prospective randomised cross-over study Single blind (patient) No details of allocation sequence generation or concealment. Jadad score 2 Meta-analysis: Diverse settings- Search strategy: Embase and Medline database from 1966 to 2002 using Ovid and Athens interphase. Citation taken from publications. BOC medical 8 studies were included Quality assessment- by Method of Jadad and Chalmers scale	Gas exchange Work of breathing and Effort of breathing (respiratory muscle pressure-time index)	PaCO ₂ fell by 2 mm Hg without oxygenation being affected Significant reduction	No details of allocation sequence generation or concealment has been described. There was no blinding of the clinicians or statisticians. Size of study is small (10 patients, out of which one withdrew his consent).
Andrews R, <i>et al</i> , 2004, UK	185 patients in Medical ICU, ED, ward and Respiratory outpatient	Systematic review	Outcome measures- Decrease in partial pressure of arterial PCO ₂ and intubation rates. Analysis excluding all papers with low methodological quality (Jadad <2) Estimated reduction in PaCO ₂ in heliox group was 0.22 kPa (+0.57 to -0.14, p=0.2) Odd ratio of intubation was 0.096 (0.03 to 0.27) - 82% reduction in risk.	Definitive beneficial evidence of heliox is lacking	8 studies were included in this meta-analysis. Quality assessments were done by method of the Jadad and Chalmers scales. Using quantitative and qualitative measures of validity author found that most trials were unsatisfactory; chief concerns being poor concealment of allocation and lack of blinding. Analysis after excluding all papers with low methodological quality (Jadad <2) revealed that definitive evidence of a beneficial role of heliox in treatment of severe COPD is lacking and therefore its wide scale use can not be recommended based on this analysis. Conclusion in this systematic review is based on review of only two papers!
G Rodrigo, <i>et al</i> , 2001	Adults >18 years of age with clinical diagnosis of COPD experiencing an exacerbation of their COPD, presenting to emergency rooms or other acute care settings. All patients were treated with either helium:oxygen or air:oxygen administered in random order.	Systematic review	primary outcome- changes in peak expiratory flow and FEV ₁ , Physiological measures symptoms & signs/symptom score (Dyspnoea score)	No significant differences in the change of FEV ₁ , PEF & FVC PaO ₂ increased with both gases, but PaCO ₂ decreased more with heliox dyspnoea score decreased more with heliox, no clinical outcome data available	

Table 1 continued

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Tassaux D, <i>et al</i> , 2000, Switzerland	23 sedated, paralysed and mechanically ventilated patients in medical ICU. Out of 25 eligible patients 2 were excluded because they could not be consented. Intervention- Intubated and ventilated patients were administered He-O ₂ for 45 min. Obs were recorded at baseline, after 45 min with He-O ₂ and then 45 min after return to air-O ₂ . The results were compared to those obtained in a test lung model using the same ventilator settings.	Prospective interventional study Non-randomised. No blinding Jadad score 1	Trapped ling vol. Intrinsic PEEP Peak airway pressure Mean airway pressure ABG, heart rate or mean systemic arterial BP	Decrease- 21.5 (SD 12.5) ml v 991.5 ml ($p < 0.05$) decrease- 9 (SD 2.5) cm v 5 (SD 2.7) cm of H ₂ O ($p < 0.05$) decline 30 (SD 5) cm v 25 (SD 6) cm of H ₂ O ($p < 0.05$) decline 8 (SD 2) cm v 7 (SD 2) cm of H ₂ O ($p < 0.05$) No change	The strength of evidence is poor. Attempts for blinding and randomisation are not mentioned. The method of treatment has not been properly described. Some patients were receiving excessive tidal volumes and respiratory rates. These patients had been intubated for surgery rather than for acute respiratory failure. Hence the severity of obstruction might have been less.
Gerbeaux P, <i>et al</i> , 2001	81 patients with exacerbation of COPD over 18 months in Emergency department. intervention- Heliox was administered by using tight fitting mask at 10 l/min with supplemental oxygen. In the standard group only oxygen was administered.	Retrospective case note review with historical control group	Intubation rate Mortality ICU stay and in-hospital stay.	Significant decrease in intubation rate (50 v 8%) Significant decrease in mortality rate (24 v 3%). Significant decrease in ICU stay (8 (SD 4) v 18 (SD 12) days) and in-hospital stay (11 (SD 7) v 17 (SD 13) days) for survivors in the heliox group.	Conclusions made from retrospective studies. Lack of blinding. Lack of data on concerning patients receiving heliox therapy. The type of intervention the patient received was decided by the treating emergency physician with varying skills, without any standardised protocol. There were only 3 out of 7 clinicians in the department who favoured the use of heliox. The patients were blinded but investigators were not: due to considerable technical difficulties. NIPSV was not strictly protocol led, nor were mechanical ventilation and weaning in intubated patients. The study does not mention how randomisation was carried out.
Jolliet P, <i>et al</i> , 2003, Switzerland	123 consecutively admitted patients with decompensated COPD over 24 months period patients for NV in ICU of 3 University Hospitals. Intervention- NIV with either He/oxygen or air/oxygen for 30 minutes Additional trial if any of the following: RR > 30/min PaO ₂ < 8 kPa PaCO ₂ > 8 kPa Intubated if resp arrest, severe resp distress, impaired consciousness, agitation or CVS collapse	Prospective randomised multicentre study (Patients partially blinded) Jadad score 2.	Intubation rate Length of stay in ITU post-ITU hospital stay post-ITU hospital stay Total hospitalisation cost	air/O ₂ 20% v He/O ₂ 13% ITU stay air/O ₂ 6.25 (SD 5.5) v He/O ₂ 5.1 (SD 4) days air/O ₂ 19 (SD 12) v He/O ₂ 13 (SD 6) days lower by \$3,348 per patient with He/O ₂	
Diedl JL, <i>et al</i> , 2003	Mean duration of trial 102 (SD 228) min 13 patients over 1 year in two medical ICU were evaluated just before and after extubation. Heliox and air/O ₂ were administered sequentially in randomised order, for 20 minutes each, just before extubation. The study was repeated after extubation in 5 patients.	Prospective randomised cross-over study Jadad score 1	Work of breathing PEEPi (intrinsic positive end expiratory pressure)	Heliox reduced work of breathing from 1.442 (SD 0.718) joules/L to 1.133 (SD 0.5) joules/L ($p < 0.05$) Slight reduction in PEEPi from 2.9 (SD 2.1) cm water to 2.1 (SD 1.8) cm water ($p < 0.05$)	The methodological quality is low (Jadad = 1). The size of sample is not sufficient (13 patients over one year). comparison after extubation was possible only in 5 patients (out of 13)
deBoisblanc BP, <i>et al</i> , 2000, USA	Convenience sample of 47 normoxic patients with acute exacerbation of COPD in ED randomised for treatment. Intervention: Nebuliser treatments using heliox or compressed air were administered at 0, 20, 40 and 120 minutes after randomisation. Spirometry was performed immediately before the first nebuliser and 1 and 2 hours later	Prospective randomised case control study Jadad score 2	Early changes in spirometry	No significant differences in the change of FEV1 and FVC between the two groups by either 1 or 2 hours point.	Randomised allocation of treatment on a convenience sample of 50 normoxic patients presenting to ED, from a pool of approximately 250 patients. Its methodological quality was low (Jadad score = 2) and it did not report concealment allocation. The most common cause for exclusion from the study was the non-availability of one of the investigators (approx. 120 patients).

COPD, chronic obstructive pulmonary disease; ED, emergency department; ICU, intensive care unit;

G Rodrigo, Pollack C, Rodrigo C, *et al.* EH Walters Heliox for treatment of exacerbations of chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews* 2001 2001, Issue 1. Art. No.: CD003571. DOI: 10.1002/14651858.CD003571.

Tassaux D, Jolliet P, Roeseler J, *et al.* Effects of Helium-oxygen on intrinsic positive end-expiratory pressure in intubated and mechanically ventilated patients with severe chronic obstructive pulmonary disease. *Critical Care Medicine* August 2000;28(8):2721–8, ISSN: 0090-3493.

Gerbeaux P, Gainnier M, *et al.* Use of heliox in patients with severe exacerbation of chronic obstructive pulmonary disease. *Critical Care Medicine* Dec 2001;29(12):2322–4, ISSN: 0090-3493.

Jolliet P, Tassaux D, Roeseler J, *et al.* Helium-oxygen versus air-oxygen noninvasive pressure support in decompensated chronic obstructive disease: A prospective multicenter study. *Critical Care Medicine* March 2003;31(3):878–84, ISSN: 0090-3493.

Diedl JL, Mercat A, *et al.* Helium/oxygen mixture reduces the work of breathing at the end of the weaning process in patients with severe chronic obstructive pulmonary disease. *Critical Care Medicine* May 2003;31(5):1415–20, ISSN: 0090-3493.

deBoisblanc BP, DeBleux P, *et al.* Randomized trial of the use of heliox as a driving gas for updraft nebulization of bronchodilators in the emergent treatment of acute exacerbation of chronic obstructive pulmonary disease. *Critical Care Medicine* May 2003;31(5):1415–20, ISSN: 0090-3493.

Is CT effective in cases of upper oesophageal fish bone ingestion?

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Three part question

In [patients who are suspected to have fish or chicken bones impacted in the oesophagus] is [computerised tomography better than plain radiography] at [identifying and localising a foreign body]?

Clinical scenario

A 60-year-old man attends the emergency department complaining that a fish bone has got stuck in his throat. Clinical examination rules out impaction within the pharynx so you are concerned that the bone has become impacted within the oesophagus. Prior experience tells you that oesophageal abrasions secondary to ingested bones can often mimic impaction, that rigid oesophagoscopy (the definitive

investigation) carries a significant mortality and morbidity rate, and that the most readily available non-invasive investigations, lateral neck and chest x rays, are often unreliable. You wonder whether a computed tomography (CT) scan of the neck would be a more accurate non-invasive tool?

Search strategy

Medline 1966—week 3, February 2006. Limit to human and English. ({exp. Tomography, Spiral Computed/or exp. Tomography, X-ray computed/or CT. mp.} AND [{fish bone. mp.} OR {foreign body. mp. OR exp. Foreign bodies}] AND {exp. Esophagus/or oesophageal. mp.})

Search outcome

Altogether 66 papers found, of which 62 were irrelevant or of insufficient quality. The remaining four papers have been systematically reviewed.

Comment(s)

The studies reviewed above clearly show that CT of the neck is an extremely accurate, non-invasive diagnostic tool with a high PPV. However, of the 58 patients in the four series with positive x ray findings, there were only 3 false-positives. Thus, disregarding study 4 (which appears to be a small-scale pilot study for study 2 with skewed results), it is unsurprising that studies 1–3 all still recommend plain x ray as the initial radiographic screening tool. Positive results, which include soft tissue changes, warrant oesophagoscopy, while negative results should lead to a CT scan of the neck. Bearing in mind that there was 100% sensitivity amongst the 144 patients undergoing CT, and that there was just one false positive amongst the 80 patients with positive results, only visualisation of an actual fish or chicken bone should result in an oesophagoscopy at this point. Similarly, a negative CT scan should confidently exclude fish and chicken bones.

► CLINICAL BOTTOM LINE

CT is more effective than plain radiography at identifying and excluding impacted oesophageal fish and chicken bones. However, plain radiography is also specific enough for positive results to warrant oesophagoscopy without any further

Table 2

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study weaknesses
Braverman I <i>et al</i> , 1993, Israel	13 patients with suspected fish and chicken bone ingestion. All patients underwent lateral neck x ray and CXR, followed by CT	Prospective, non-randomised study	Sensitivity Specificity PPV	CT: 100%, XR: 80% CT: 100%, XR: 50% CT: 100%, XR: 88.9%	Low study numbers One patient underwent CT after oesophagoscopy, & one did not have an x ray—both have been excluded from the results Statistics were not reported (calculated by ourselves again)
Watanabe K <i>et al</i> , 1998, Japan	32 patients with suspected fish bone ingestion. All patients underwent lateral neck x ray and CXR, but only 11 underwent CT	Prospective, non-randomised study	Sensitivity Specificity PPV	CT: 100%, XR: 44% CT: N/A, XR: 100% CT: 100%, XR: 100%	Selection bias—why only 11 patients for CT? Low study numbers for CT Statistics were not reported by authors (they have been calculated by ourselves)
Eliashar R <i>et al</i> , 1999, Israel	45 patients with suspected fish and chicken bone ingestion. All patients underwent lateral neck x ray and CXR, followed by CT	Prospective, non-randomised study	Sensitivity Specificity PPV	CT: 100%, XR: 55.2% CT: 93.7%, XR: 100% CT: 96.7%, XR: 100%	
Akazawa Y <i>et al</i> , 2004, Japan	76 patients with suspected fish bone ingestion. All patients underwent lateral neck x ray and CXR, followed by CT	Prospective, non-randomised study	Sensitivity Specificity PPV	CT: 100%, XR: 64.5% CT: 100%, XR: 95.6% CT: 100%, XR: 90.9%	XR sensitivity miscalculated by authors as 54.8%

CT, computed tomography; CXR, chest x ray; PPV, positive predictive value.